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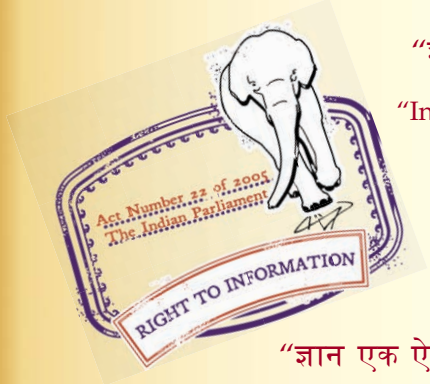
IS 8252-16 (1979): Environmental tests for aircraft equipment, Part 16: Shock [TED 14: Aircraft and Space Vehicles]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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Indian Standard (Reaffirmed 2005)

ENVIRONMENTAL TESTS FOR AIRCRAFT EQUIPMENT

PART XVI SHOCK

Aircrafts and Space Vehicles Sectional Committee, EDC 74; *and* Environmental and Operating Conditions for Aircraft Equipment Subcommittee, EDC 74 : 4 [Ref : Doc : EDC 74 (2986) F1]

1. Scope

1.1 This standard specifies the characteristics of a shock test and states the three degrees of stress severity to be used to experimentally recreate an environment which is representative of that which the equipment may encounter during service use.

1.2 This standard does not apply to flight (crash) recorders or to passenger and freight restraint systems for which special, separate, requirements exist.

2. Description of Test

2.1 *Object* — The object of the test is to check the behaviour of an item of aircraft equipment which is subjected to shocks in normal operation (for example landing, arrested landing, etc), and in the event of an accident that it will not hazard the safety of the aircraft or its occupants.

2.2 *Effects* — The test is intended to highlight the following adverse effects:

a) Functioning faults,

b) The operation of anti-vibration mounts to their stops,

c) Hazarding of safety due to breakage of equipment or its mounting system, and

d) Risk of explosion or fire arising from mechanical destruction.

3. Test Apparatus

3.1 *Apparatus* — The test apparatus shall be capable of generating acceleration pulses having the characteristics selected from the shapes detailed in **3.2**. The shock pulses are defined by the maximum acceleration *A* and duration *D*.

3.2 *Pulse Shapes* — The generated pulses shall approximate to one of the nominal acceleration versus time curves listed below:

a) Half-sine, in accordance with Fig. 1;

b) Final peak sawtooth, in accordance with Fig. 2;

c) Trapezoidal, in accordance with Fig. 3.

3.3 *Pulse Tolerances* — The tolerances on the pulses shall be as follows:

a) Acceleration *A*, as indicated in Fig. 1, 2 and 3;

b) Duration *D*, ± 10 percent of the nominal value; and

c) Velocity change, ± 10 percent of the value corresponding to the nominal pulse.

To determine the changes in the velocity, the actual pulse acceleration should be integrated from the time 0·4 *D* before the start of the pulse to the time 0·1 *D* after the duration of the pulse, *D* being the nominal pulse duration.

The nominal values of the variation in velocity corresponding to each pulse shape are as stated in Table 1.

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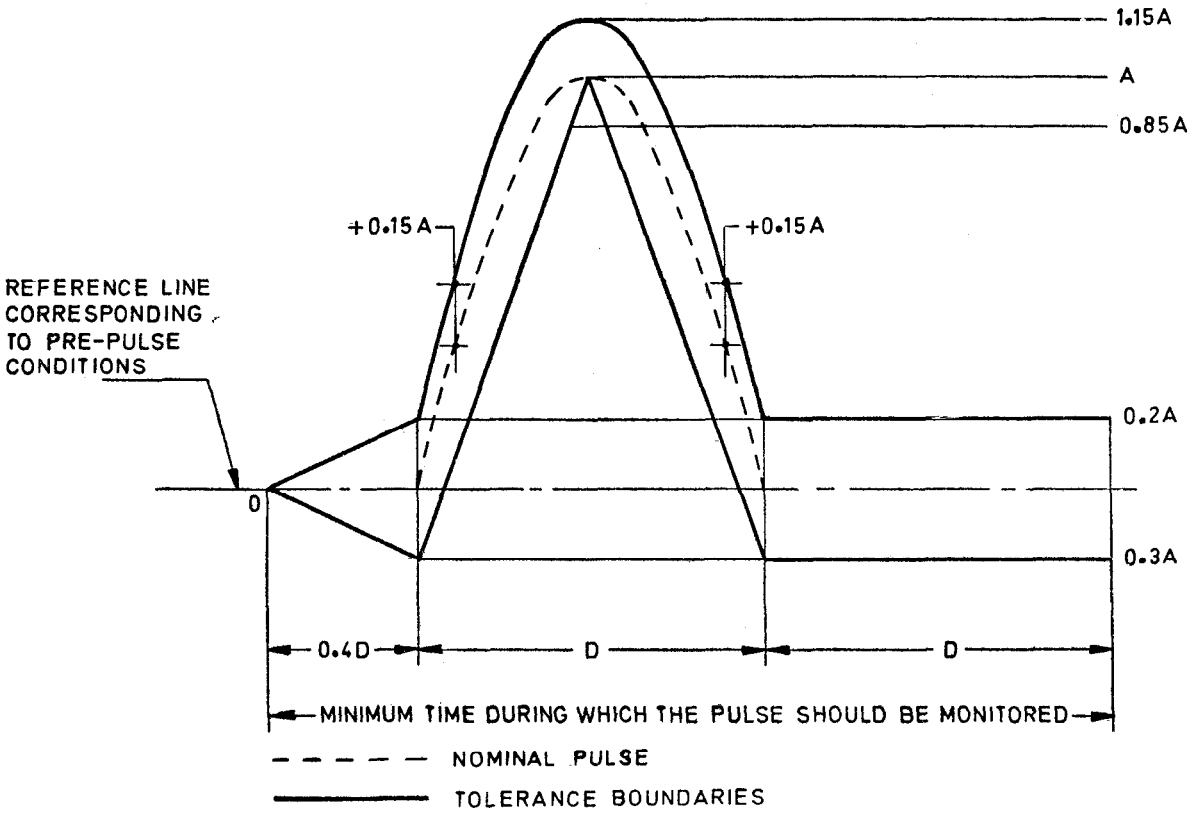
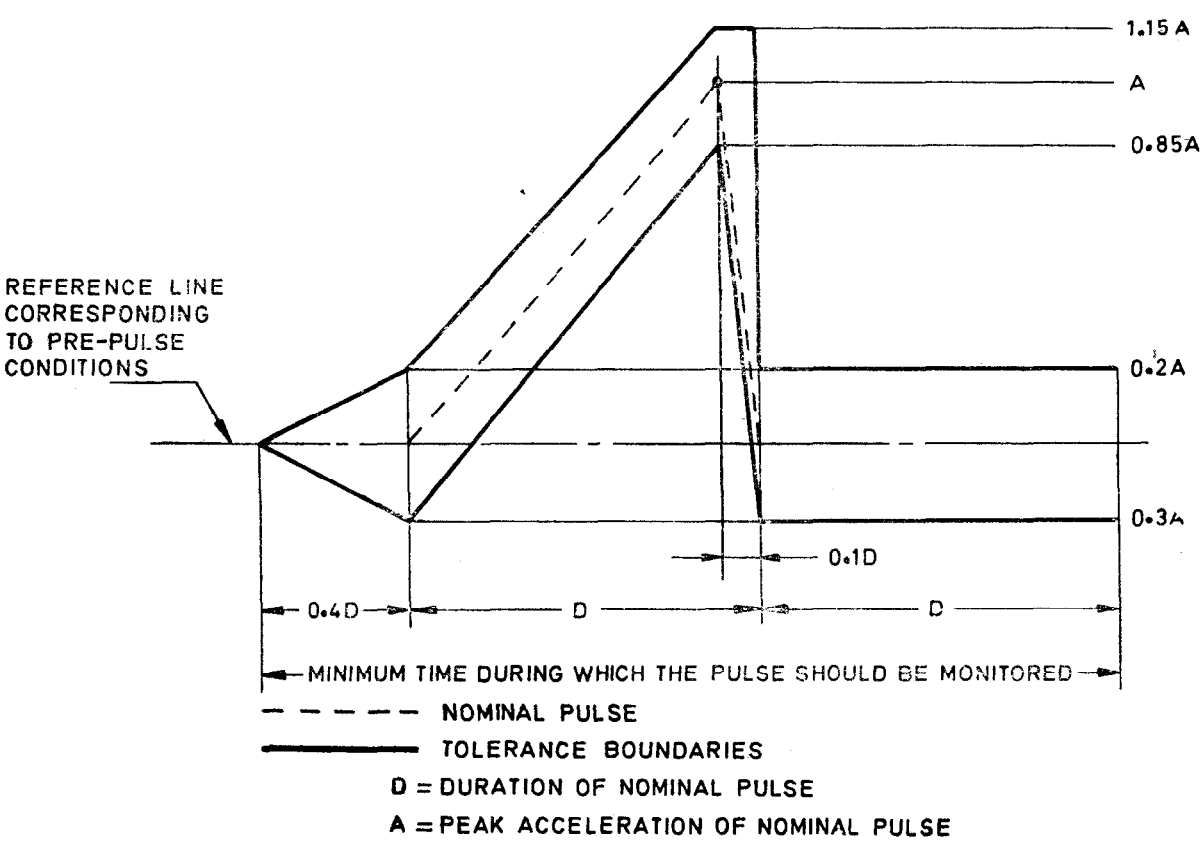


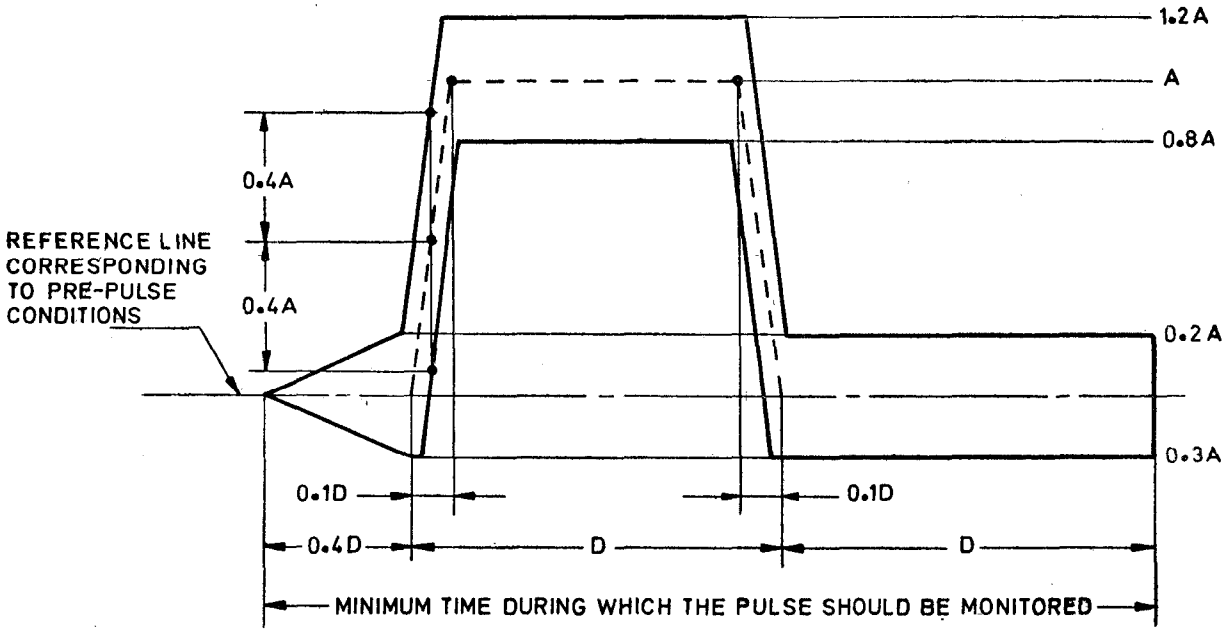
The reference line shall not differ more than ± 0·05 *A* or ± 9·8 m/s² (± 1 g), whichever is the greater, from zero acceleration.

FIG. 1 HALF-SINE PULSE



The reference line shall not differ more than ± 0·05 *A* or ± 9·8 m/s² (± 1 g), whichever is greater, from zero acceleration.

FIG. 2 FINAL PEAK SAWTOOTH PULSE



— — — — NOMINAL PULSE

——— TOLERANCE BOUNDARIES

D = DURATION OF NOMINAL PULSE

A = PEAK ACCELERATION OF NOMINAL PULSE

The reference line shall not differ more than ± 0·05 *A* or ± 9·8 m/s² (± 1 g), whichever is greater, from zero acceleration.

FIG. 3 TRAPEZOIDAL PULSE

TABLE 1 PULSE VELOCITY CHANGE
(*Clause* 3.3)
Velocity Change

Half-sine	Sawtooth	Trapezoidal
m/s	m/s	m/s
$\frac{2\,AD}{\pi}$	$\frac{AD}{2}$	0·9 *AD*

3.4 *Measuring Systems* — The measuring systems for recording the shocks imparted by the test apparatus and also for the response at different points on the equipment, shall have the accuracy specified in Table 2.

TABLE 2 ACCURACY OF MEASURING SYSTEMS

Band Pass Frequency	Accuracy
5 to 5 000 Hz	Actual value ± 1 dB of the reference value displayed at 100 Hz
1 to 5 Hz inclusive	Actual value ± 10 dB of the reference value displayed at 100 Hz

Wherever possible, it is recommended that:

a) the accelerometers in these measuring systems have a flat response between 5 000 and 25 000 Hz and over this frequency range shall not exceed the reference value displayed at 100 Hz by more than 1 dB;

b) the measuring systems should be able to pass the continuous component with an attenuation lower than −10 dB of the reference value displayed at 100 Hz.

3.5 *Measurement of the Reference Shock* — The reference shock shall be measured either:

a) on the table of the machine (when the fixing frame has no resonance below 2 000 Hz); or

b) on the fixing frame, at the same level as the equipment fixing point or points (when the frame has one or more resonance frequencies below 2 000 Hz).

In the latter case, the acceleration of the reference shock shall be measured along the three axes of the reference system.

3.6 *Measurement of Shock Obtained from the Equipment* — When interference from harmonics is present in the shocks recorded from the equipment, it is recommended that a low-pass filter should be inserted in the measuring systems.

In this case, the test results shall provide, for each measurement:

a) a recording without filtering; and

b) a recording with filtering, together with an indication of the cut-off frequency of the filter and of its slope.

4. Installation of the Equipment — The equipment to be tested shall be mounted on the table of a shock machine via a fixing frame. The fixing frame shall:

a) allow the equipment to be orientated so that it can be subjected to shocks directed successively in six directions defined by a reference system involving three mutually perpendicular axes, which is related to the equipment;

b) permit the attachment of the equipment by the fixing points or device (for example, anti-vibration mountings) prescribed in the installation manual;

c) not distort the shock imparted by the machine and, to this end, shall not, if possible, have a resonance frequency below 2 000 Hz when loaded with the equipment; and

d) permit the formation of electrical, pneumatic, hydraulic, etc, connections which are as closely as possible representative of those specified in the installation manual.

5. Initial Measurements — Before commencing the test, the equipment shall be visually inspected and functionally checked in accordance with the relevant equipment specification.

6. Classification of Test

6.1 The relevant equipment specification shall specify the relevant test severity selected from Table 3.

TABLE 3 TEST SEVERITIES

Test Severity	Type of Aircraft in which Equipment to be Installed
1	Light aircraft Transport aircraft
2	High-performance aircraft
3	Aircraft equipped with armaments or exposed to effects of explosion or blast

6.2 *Types of Test* — The following two types of test shall be conducted.

6.2.1 *Functioning test* — A test complying with Table 4 which checks the functioning of the equipment while being subjected to the shock pulses.

TABLE 4 TEST CHARACTERISTICS AND PROCEDURES

(*Clauses* **6.2.1, 6.2.2, 7** *and* **8**)

Type of Test	Test Severity	Acceleration A Max		Pulse Duration D Nom	Pulse Shape	Number of Shocks per Direction	Number of Directions (See Note 1)	Test Procedures
		m/s^2	g	ms				
Functioning	1	59	6	11	(*see* Note 2)	3	6	*Category A and B equipment* (*see* **6.3.1.1**) Operate the equipment throughout this test at the maximum rating stated in the relevant equipment specification. 1) Allow at least 5 *min* of such operation and subject equipment to three shocks. If required by the relevant equipment specification, monitor the specific functional parameters during period of each shock. 2) Functionally check equipment in accordance with the relevant equipment specification. Also visually check equipment submitted to test severity 3 in accordance with stage 2) of the structural integrity test detailed below. 3) Re-orientate equipment. 4) Repeat (1), (2) and (3) the appropriate number of times.
	2	147	15	11				
	3	980	100	6				
Structural integrity (*see* Note 3)	1	147	15	11	(*see* Note 2)	3	6	*Category A and B equipment* (*see* **6.3.1.1**) Equipment to be inoperative throughout this test 1) Submit equipment to three shocks. 2) Visually check equipment. Although the equipment may be destroyed, it shall remain integral with its mounting system and no component shall become detached. 3) Re-orientate equipment. 4) Repeat (1), (2) and (3) the appropriate number of times. *Category C equipment* (*see* **6.3.1.2**) Follow the procedure for the functioning test above. Special case (*see* **6.3.1.3**)
	2	294	30	11				

Note 1 — The number of shock directions, described in **4(a)**, may be reduced if permitted by the relevant equipment specification.

Note 2 — The appropriate shock pulse shape, selected from **3.2**, shall be stated in the relevant equipment specification. If the pulse shape is not specified, the half-sine shall preferably be adopted.

Note 3 — During the structural integrity tests, and if permitted by the relevant equipment specification, certain mechanical or electrical components may be replaced by an equivalent mass. This mass shall be as close as possible to the mass of the component it replaces, and shall be fitted in such a way that the centre of gravity of the equipment is altered as little as possible. The substitute mass shall in no way contribute to an improvement of the mechanical characteristics of the equipment.

6.2.2 *Structural integrity test* — A test complying with Table 4 which checks the ability of the equipment not to endanger safety. The test is applicable to the following three categories of equipment:

a) *Category A equipment* : Equipment which shall function after, but not during, the application of the shock pulses.

b) *Category B equipment* : Items of equipment which are not required to function during, or after, application of the shock pulses, but which shall remain free from structural damage which would give rise to either:

1) breakage of the attachment systems of part, or the whole, of the equipment; or

2) risks of fire, explosion or leakage of dangerous fluids.

c) *Category C equipment* : Items of equipment which shall function during the application of the shock pulses (for example, safety devices, etc).

The relevant equipment specification shall state the appropriate category of the equipment.

6.3 *Test Sequence*

6.3.1 *Test severities 1 and 2* — The sequence of tests shall be as follows:

6.3.1.1 *Category A and B equipment* — The functioning test shall be conducted first in each of the six directions required by the relevant equipment specification in accordance with 4(a), and then shall be followed by the structural integrity test in the same six directions.

6.3.1.2 *Category C equipment* — The structural integrity test only shall be carried out, but the procedure for the appropriate functioning test shall be followed.

6.3.1.3 *Special cases*

a) If desired and if approved by the Approving Authority, the structural integrity test may be carried out immediately after the functioning test in each attitude before re-orienting the equipment.

This modified sequence limits the number of operations involving repositioning on the shock machine.

b) If it is not possible to conduct a functioning test, and if approved by the Approving Authority, only the structural integrity test shall be conducted. A visual and functioning check, in accordance with the relevant equipment specification shall, however, also be made after each of the six stages of the structural integrity test.

6.3.2 *Test severity 3* — The functioning test only should be carried out.

7. Test Procedure — The functioning and structural integrity test shall adopt the shock pulse characteristics and procedures described in Table 4.

8. Information to be Stated in the Relevant Equipment Specification — If the shock test is specified in the relevant equipment specification, the following information shall be stated, as far as it is applicable:

	Relevant Clause or Sub-clause
a) Required pulse (if other than half-sine)	3.2 and Table 4 Note 2
b) Orientation of the equipment	4(a)
c) Reduction in number of direction (if permissible)	Table 4, Note 1
d) Test severity	6.1

e) Equipment category (structural integrity test)	6.2.2
f) Test sequence and required checks (if a special case)	6.3.1.3
g) Substitution for certain components (if permissible)	Table 4, Note 2
h) Initial measurements - Detail visual and functional checks	5
j) Requirements for equipment operation and parameters to be monitored during functioning tests (if applicable)	Table 4
k) Operational checks to be made on equipment following shock in each direction during functioning tests	Table 4
m) Special requirements for visual checks on equipment	Table 4

EXPLANATORY NOTE

This standard is one of the series of standards relating to the environmental and operating conditions for aircraft equipment. The scope and applicability of these standards is outlined in IS : 8252 (Part I)-1976 ' Environmental tests for aircraft equipment : Part I General '.

This standard is based on ISO/DIS 2670 Environmental tests for aircraft equipment—Part 3.3 : Shock, issued by International Organization for Standardization.

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